Crew Worn Acceleration Recorder for Spaceflight, Phase I

Completed Technology Project (2018 - 2019)

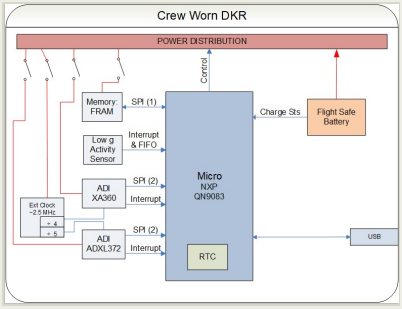
Project Introduction

As early as the Gemini missions, NASA has monitored physiological parameters during spaceflight for the collection of real time and recorded data during critical missions. This has helped NASA better understand man's reaction to space by monitoring astronauts' temperature, respiration, and cardiac activity. The proposed Dynamic Kinematic Recorder (DKR) is designed to measure the biomechanical vibration, impact and motion of astronauts' head, neck, body and helmet. Astronauts can be subjected to excessive vibration and shock during launch, re-entry or abort scenarios. Biomechanical measurements in these conditions have unique challenges. Safety of flight is essential and the proposed DKR is required to be an ultra-low power system that minimizes size and weight and runs autonomously. DTS has unique experience developing similar systems over the past 27 years, including work with NASA measuring crew biomechanics. DTS has developed systems to measure the kinematic motion of rodeo riders, aerobatic pilots, ejection seat manikins, roller coaster riders, soldiers in combat, and most recently football players through a research project funded by the NFL. All DTS systems are designed in accordance with SAE J211 recommendations. Recent technology advances in MEMS sensing and microprocessor technology now make it possible to deliver a relatively low cost, small, light and autonomous system to measure crew biomechanics. Unique to this proposal is a technical breakthrough in angular sensing technology that reduces size and power by orders of magnitude. DTS proposes to deliver a revolutionary prototype 6DOF Dynamic Kinematic Recorder that will have greater than 10-fold reduction in size and mass compared to existing systems. This autonomous system would be small, ultra-low power and weigh less than 20 grams.

Anticipated Benefits

Due to its ultra-low power and miniature size, the development of the proposed Dynamic Kinematic Recorder (DKR) will allow for the monitoring of biomechanical linear and angular accelerations in applications where it was not practical to do so with previous solutions. The DKR can be used to monitor astronaut exposure to vibration and shock, as well as monitoring seat or other spacecraft structures.

The Dynamic Kinematic Recorder (DKR) has wide application in other industries. First and foremost is the measurement of head motion to help understand traumatic brain injury in sports and soldiers in blast and field environments. Other applications include high value asset monitoring during shipping. A DKR could be attached to the asset to monitor shock and vibration levels during transit.



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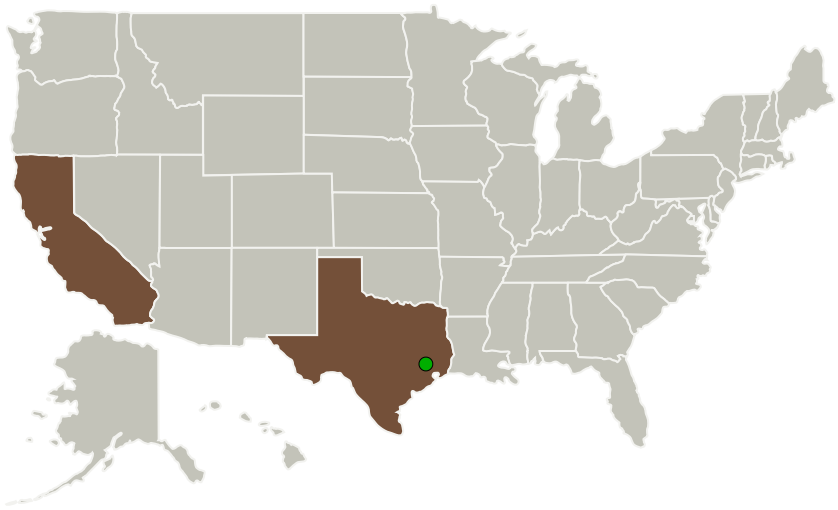
Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
Diversified Technical Systems, Inc.	Lead Organization	Industry	Seal Beach, California
Johnson Space Center(JSC)	Supporting Organization	NASA Center	Houston, Texas

Primary U.S. Work Locations	
California	Texas

Project Transitions

July 2018: Project Start

February 2019: Closed out

Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/140991)*

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Diversified Technical Systems, Inc.

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Project Managers:

Karen D Pickering
Kathryn B Packard

Principal Investigator:

Michael Beckage

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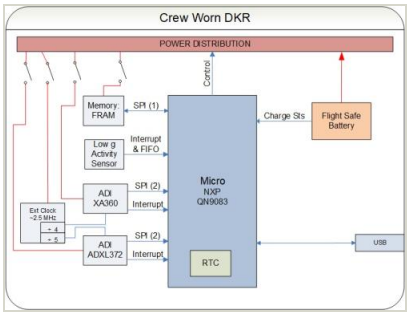
Images

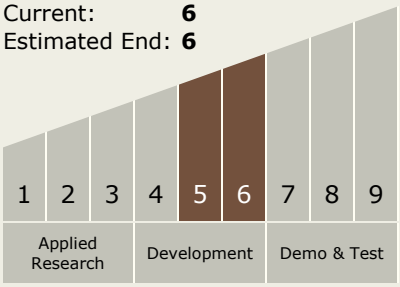


Briefing Chart Image
Crew Worn Acceleration Recorder for Spaceflight, Phase I *(https://techport.nasa.gov/image/131953)*

Final Summary Chart Image
Crew Worn Acceleration Recorder for Spaceflight, Phase I *(https://techport.nasa.gov/image/127054)*

Technology Maturity (TRL)

Start: **5**
Current: **6**
Estimated End: **6**



Target Destinations

Earth, The Moon, Mars